

**WHAT IS CLAIMED IS:**

1. A fuel metering unit for controlling a variable displacement pump comprising:  
  
a metering valve in fluid communication with the pump for metering an output of the fuel metering unit;  
  
a flow line for creating a spill return flow from an output of the pump;  
  
a pressure regulator in fluid communication with the flow line for receiving the spill return flow; and  
  
a control valve for regulating the spill return flow to a substantially constant small level to prevent excessive heat generation during recirculation by setting a displacement of the pump.
2. A fuel metering unit as recited in Claim 1, further comprising a servo mechanism operatively connected to the spill return flow for determining the output of the pump and thereby the spill return flow.
3. A fuel metering unit as recited in Claim 2, wherein the servo mechanism is a half area servo mechanism.

4. A fuel metering unit as recited in Claim 2, further comprising a static pressure line between the output of the pump and the servo mechanism for facilitating a proper setting of the servo mechanism.

5. A fuel metering unit as recited in Claim 1, further comprising a static flow line between the output of the fuel metering unit and the pressure regulator for facilitating a proper setting of the pressure regulator.

6. A fuel metering unit as recited in Claim 1, further comprising an orifice operatively connected to the output of the pressure regulator for creating a pressure differential across the control valve.

7. A fuel metering unit 10 for controlling a variable displacement pump actuated comprising:

a servo mechanism for varying an output of the pump;

a metering valve operatively connected to the output of the pump and an engine such that actuation of the metering valve controls an output of the fuel metering unit so as to schedule fuel flow accurately to the engine;

a spill return flow line connected between the output of the pump and the metering valve;

a first regulator operatively connected to the spill return flow line such that a first pressure differential across the first regulator determines an output of the first regulator; and

a second regulator operatively connected to the output of the first regulator and the servo mechanism such that the output of the first regulator is regulated during a steady-state condition, and during a transient condition, a second pressure differential across the second regulator varies to adjust an output of the second regulator to, in turn, adjust the servo mechanism to vary the output of the pump such that a subsequent flow in the spill return line is substantially equal to a desired flow.

8. A fuel metering unit as recited in Claim 7, further comprising a feedback line connected between the output of the pump and the servo mechanism.

9. A fuel metering unit as recited in Claim 7, a static sensing line connected between the metering valve and the engine.

10. A fuel metering unit as recited in Claim 7, a servo line connected between the pump and the metering valve.

11. A fuel metering unit for controlling a variable displacement pump comprising:  
first means in fluid communication with the pump for metering an output of the pump;  
second means in fluid communication with the first means to create a bypass flow for responding to transients; and

third means in fluid communication with the second means and the pump for regulating the bypass flow so bypass flow is substantially constant by variably setting a displacement of the variable displacement pump.

12. A fuel metering unit as recited in Claim 11, wherein the first means is a metering valve.

13. A fuel metering unit as recited in Claim 11, wherein the second means is a first regulator.

14. A fuel metering unit as recited in Claim 11, wherein the third means is a second regulator.

15. A fuel metering unit as recited in Claim 11, further comprising a fourth means operatively connected to the bypass flow for determining the output of the pump.

16. A fuel metering unit as recited in Claim 15, wherein the fourth means is a servo mechanism.

17. A method for maintaining a constant spill return flow in a fuel metering unit that provides fuel to an engine, the method comprising the steps of:

- metering an output of a variable displacement pump;
- creating a spill return flow from the output of the variable displacement pump to allow for quick response when additional fuel is required by the engine;
- regulating the output of the pump with a regulator based upon the spill return flow;
- regulating an output of the first regulator with a control valve to maintain the spill return flow substantially constant; and
- adjusting a displacement of the pump based upon an output of the control valve.

18. A method as recited in Claim 17, further comprising the step of adjusting a position of a servo mechanism based upon the output of the control valve to determine the displacement of the pump.

19. A method as recited in Claim 17, further comprising the step of creating a pressure differential between two inputs of the control valve to determine the output of the control valve.

20. A method as recited in Claim 17, wherein an input of the control valve is in fluid communication with the output of the pump through a flow line.